Efficacy of an Intra-Operative Imaging Software System for Anatomic Anterior Cruciate Ligament Reconstruction Surgery

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ABSTRACT

An imaging software system was studied for improving the performance of anatomic anterior cruciate ligament (ACL) reconstruction which requires identifying ACL insertion sites for bone tunnel placement. This software predicts and displays the insertion sites based on the literature data and patient-specific bony landmarks. Twenty orthopaedic surgeons performed simulated arthroscopic ACL surgeries on 20 knee specimens, first without and then with the visual guidance by fluoroscopic imaging, and their tunnel entry positions were recorded. The native ACL insertion morphologies of individual specimens were quantified in relation to CT-based bone models and then used to evaluate the software-generated insertion locations. Results suggested that the system was effective in leading surgeons to predetermined locations while the application of averaged insertion morphological information in individual surgeries can be susceptible to inaccuracy and uncertainty. Implications on challenges associated with developing engineering solutions to aid in re-creating or recognizing anatomy in surgical care delivery are discussed.

Keywords: ACL reconstruction, anatomy, image-guided surgery, tunnel placement

1. INTRODUCTION

The anterior cruciate ligament (ACL) is a major restraining ligament in the knee joint. ACL injuries can result in pain, joint instability, and different degrees of disability ranging from reduced participation in sports to difficulties with activities of daily living. Reconstructive surgery is the standard of care for most patients seeking for treatment for an ACL injury, and there can be as many as 175,000 such procedures performed

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